

the Mechelectric



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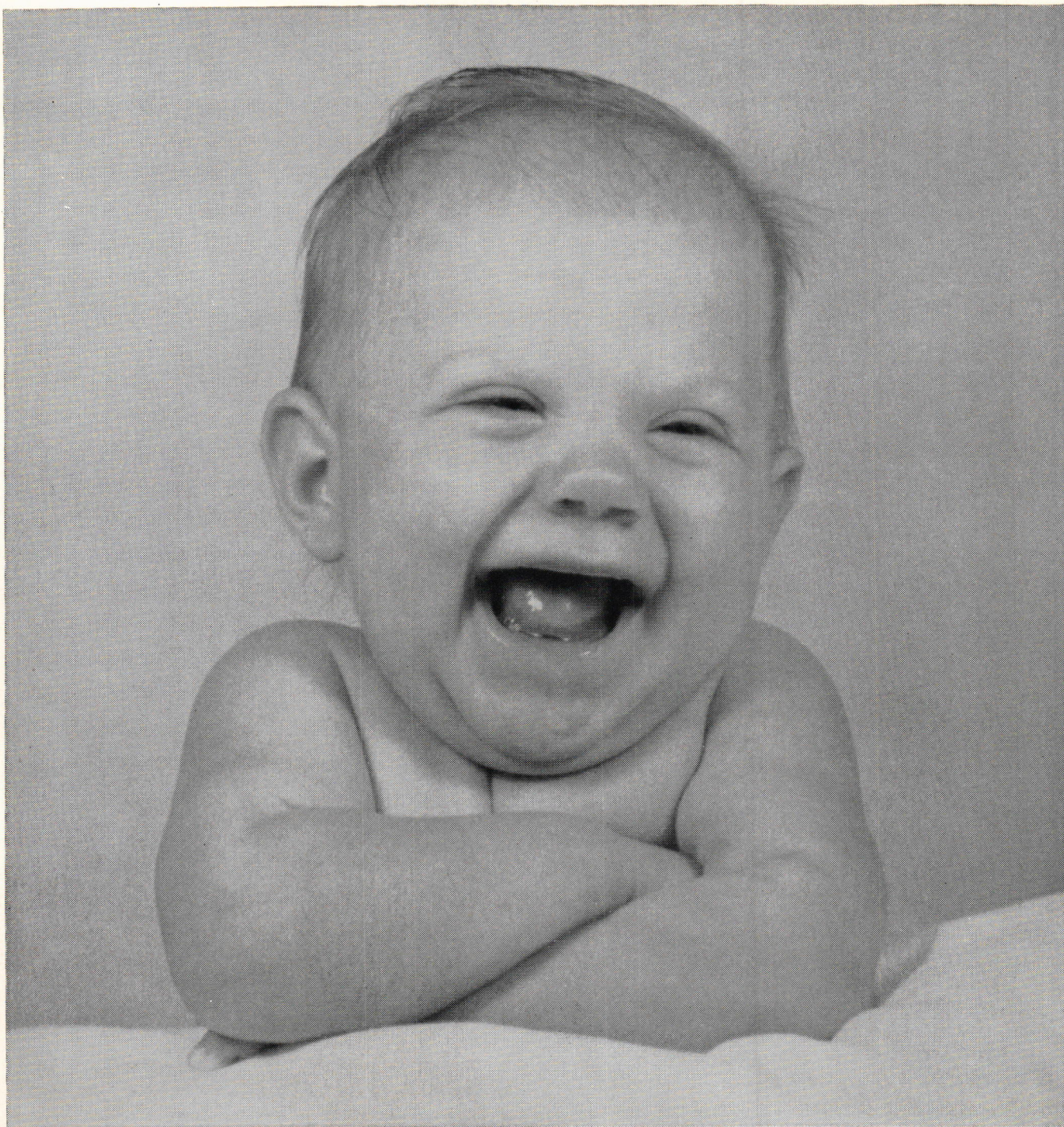
NO. 5

**School of Engineering
The George Washington
University**



A TOTAL BOARD WHICH RECORDS STOCK MARKET QUOTATIONS

APRIL 1959



"So then U.S. Steel invested \$770 million in us"

An American baby is born every eight seconds—11,000 every day—4,000,000 a year. Our population will soon be over 200 million. And as our population grows, our production must grow. We'll need millions of new homes . . . new schools and hospitals . . . new highways to carry 75 million motor vehicles by 1970 . . . not to mention countless appliances and conveniences that haven't even been invented yet!

No temporary setback can stop the growing needs of our population. That's why United States Steel has gone ahead with expenditures totaling \$770 million to provide more and better steels for tomorrow's citizens. This is the practical way that we've demonstrated our faith in the future.

USS is a registered trademark



United States Steel



some bridges

must be crossed

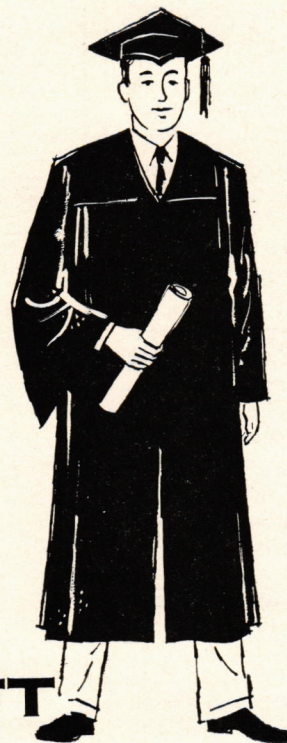
before you come to them

Clearly there *are* such bridges. You started to cross one of them when you tackled a college education. By electing an engineering course, you took additional steps. It's the bridge that takes you from education to profession.

Perhaps several companies on the "profession side" will beckon to you. Naturally, you'll try to choose the firmest and highest ground accessible to a beginner—ground that leads to more challenge, more responsibility and greater reward. Companies situated on the firmest and highest ground will be those whose products or services enjoy a lively and continuing demand.

As a leader in a broad and exciting field, Sikorsky Aircraft is just such a company. And as an organization with its eye on the future, each year Sikorsky has openings for young men who show promise of being able to make outstanding contributions to the development of direct-lift aircraft.

If you're almost across that education-to-career bridge, write for information about careers with the world's pioneer helicopter manufacturer. Please address Mr. Richard L. Auten, Personnel Department.



SIKORSKY AIRCRAFT



ONE OF THE DIVISIONS OF UNITED AIRCRAFT CORPORATION

STRATFORD, CONNECTICUT

Why metals corrode...and how to prevent it

The equipment you will design most probably will have to stand up against one or more of these 6 different forms of corrosive attack:

1. General tarnishing or rusting with occasional perforations in highly affected areas.
2. Highly localized attack by pitting.
3. Cracking induced by a combination of stress and corrosion.
4. Corrosion confined to crevices, under gaskets, or washers, or in sockets.
5. Corrosion of one of an alloy's constituents leaving a weak residue.
6. Corrosion near the junction of two different metals.

HOW CORROSION OCCURS

The basic cause of corrosion is the instability of metals in their refined state. Metals tend to revert to their natural states through the processes of corrosion. For example, when you analyze rust, you will find it is iron oxide. When you analyze natural iron ore, you find it, too, is iron oxide.

In all of the six forms of corrosion mentioned above, corrosion has the same basic mechanism. It's similar to the electrochemical action in a dry cell.

The electrolyte in the dry cell corresponds to the corrosive media, which may be anything from the moisture in the air to the strongest alkali or acid.

The plates of the battery correspond to the metal involved in corrosion.

A potential difference between these metals or different areas on the same metal causes electricity to flow between them through the electrolyte and a metallic bridge or contact that completes the circuit.

At the anode, a destructive alteration or eating away of metal occurs when the positively charged atoms of metal detach from the solid surface and enter the solution as ions.

The corresponding negative charges, in the form of electrons, travel through the metal, through the metallic bridge, to the cathode.

Briefly then, for corrosion to occur, there must first be a difference in potential between the metals or areas on the same piece of metal so that electricity will flow between them. Next, a release of electrons at the anode and a formation of metal ions through disintegration of metal at the anode. At the cathode, there must be a simultaneous acceptance of electrons. Action at the anode cannot go on alone, nor can action at the cathode.

CONTROLLING CORROSION

When corrosion occurs because of the differences in electrical potential of dissimilar metals, it is known as galvanic action. Differences in potential from point to point on a single metal surface causes corrosion known as local action.

When you plan against galvanic corrosion it is essential to know which metal in the couple will suffer accelerated corrosion... will act as the anode in the corrosion reaction.

The galvanic series table shown below can supply this information. In any couple, the metal near the top of this series will be the anode and suffer accelerated corrosion in a galvanic couple. The one nearer the bottom will be the cathode and remain free from attack or may corrode at a much slower rate.

GALVANIC SERIES TABLE

Magnesium
Magnesium alloys
Zinc
Aluminum 25
Cadmium
Aluminum 17ST
Steel or Iron
Cast Iron
Chromium-iron (active)
Ni-Resist*
18-8 Chromium-nickel-iron (active)
18-8-3 Chromium-nickel-molybdenum-iron (active)
Hastelloy "C"
Lead-tin solders
Lead
Tin
Nickel (active)
Inconel* (active)
Hastelloy "A"
Hastelloy "B"
Brasses
Copper
Bronzes
Copper-nickel alloys
Monel*
Silver Solder
Nickel (passive)
Inconel (passive)
Chromium-iron (passive)
18-8 Chromium-nickel-iron (passive)
18-8-3 Chromium-nickel-molybdenum-iron (passive)
Silver
Graphite
Gold
Platinum

HOW TO USE THE CHART

Notice how the metals are grouped in the galvanic series table. Any metal in one group can be safely used with any other metal in the same group. However, when you start mixing metals from different groups, you may run into serious galvanic corrosion of the metal higher on the list. And the further apart these metals are listed, the worse this corrosion may be.


But, if you have to mix metals, pay particular attention to the electrical contact between them. Eliminate any metallic bridges or contacts of metal to metal that will permit the flow of electrons through them. You can do this by separating the metals physically, or by using insulation or protective coatings. Another factor is the relative areas of the metals in contact with each other. Parts having the smaller area should be of a metal with a lower listing on the galvanic series table than the metal used for the larger area.

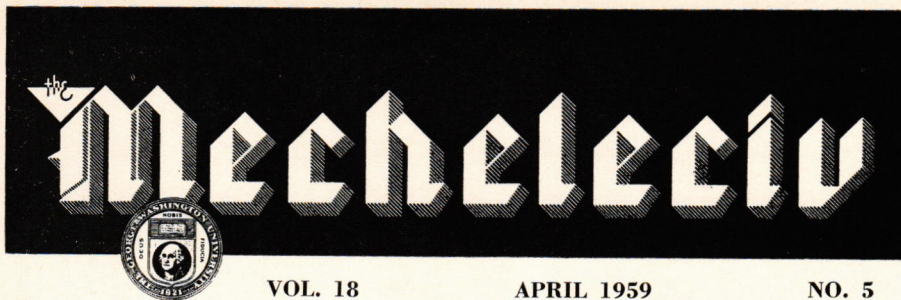
When you plan against local action, keep in mind that the corrosion process is similar to galvanic action... a movement of electrons from one point on the metal to another. Naturally, the easiest way to avoid local action is to use a metal with little or no impurity... or an alloy with constituents that are listed closely on the galvanic series table. Local action on other metals, however, can be controlled by stopping any flow of electrons... such as with protective coatings. Environment, too, is a factor for consideration.

FILM ON CORROSION AVAILABLE TO ENGINEERING CLASSES

Inco's full-color sound film — "Corrosion in Action" — gives a graphic explanation of corrosion and how to control it. The film is in three parts: The Nature of Corrosion, 20 minutes running time; Origin and Characteristics of Corrosion Currents, 26 minutes; Passivity and Protective Films, 17 minutes. 16mm prints can be loaned to engineering classes. For details, write Inco for descriptive folder on "Corrosion in Action."

*Registered trademark

The INTERNATIONAL NICKEL COMPANY, Inc.
67 Wall Street  New York 5, N. Y.



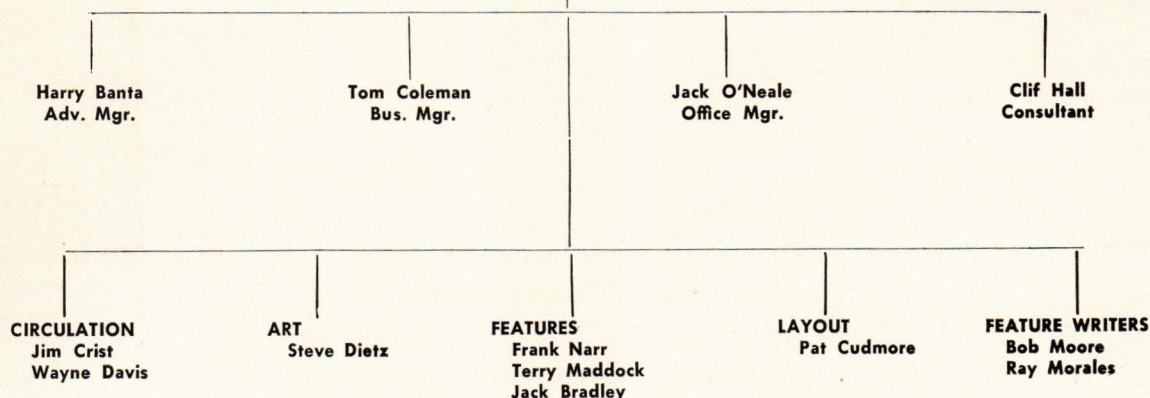
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THE EDITORS PAGE...

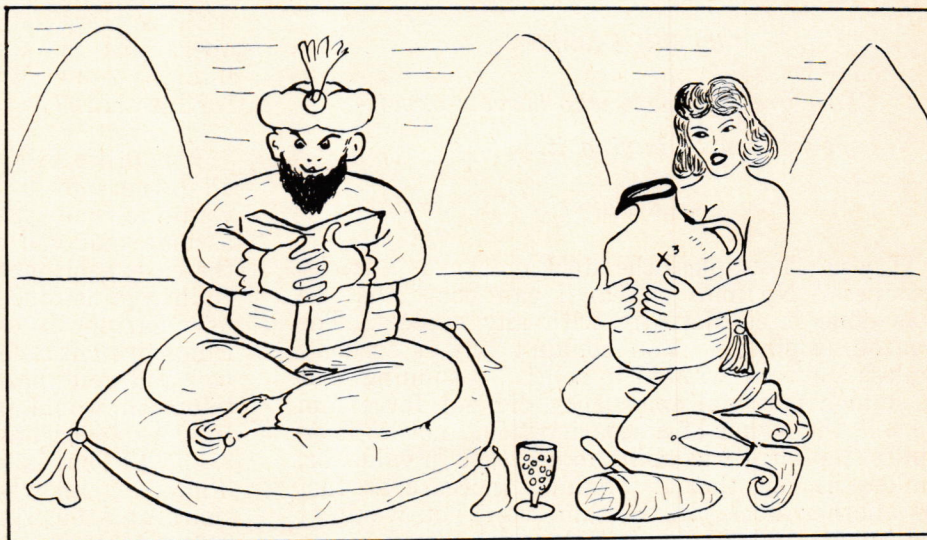
The most important function on the Engineering School social calendar will occur the night of May 9 at the Presidential Arms. The annual Engineers Banquet and Ball will commemorate the 75th year of the School of Engineering, and the Engineers' Council has taken elaborate steps to make this evening a real success. On the program for the Banquet will be all the important awards of the year for the engineering students. Included in this program will be the Outstanding Freshman award of Sigma Tau, the student awards of the professional societies, and the highly-coveted Theta Tau Activities Award to the senior who has participated heavily in engineering extracurriculas.

The main speaker of the evening will be past Dean Feiker, the only living ex-dean of the School of Engineering. He will be introduced by Professor Emeritus B. C. Cruichshanks, a longtime member of the faculty of the School of Engineering.

Later in the evening, musical entertainment will be provided by the band of Dave Platt, a musician of note in the Washington area. The Ball will begin at approximately 9:00 P.M. and tickets may be purchased from any member of the Engineers' Council. The time of the Banquet is 7:30 P.M. and the tickets for both the Banquet and Ball are now on sale for \$10 per couple.

Every student should make an extra effort to attend this gala evening.

The Thinkers' Page



THE INDISPENSABLE MAN

*Sometime when you're feeling important;
Sometime when your ego's in bloom;
Someetime when you take it for granted
You're the best qualified in the room;
Sometime when you feel that your going
Would leave an infallible hole,
Just follow these simple instructions
And see how it humbles your soul.
Take a bucket and fill it with water.
Put your hands in up to your wrists.
Pull them out and the hole that remains
Is a measure of how you'll be missed.
You may splash all you please when you enter;
You may stir up the water galore;
But stop and you'll find in a minute
That it looks just the same as before.
The moral of this is quite simple:
Do just the best that you can;
Be proud of yourself but remember
There is no indispensable man!*

MUTUAL FUNDS: DOLLARS AND SENSE

by Bill Franklin

Those are fortunate who borrow experience instead of buying it.

—Marguerite Blessington.

Trying to outguess the stock market is a tricky business. No man on earth can boast that he has done it consistently with any success. The reason is simple. You couldn't buy a security unless someone wanted to sell it. Assuming that a sudden personal emergency did not force him to sell, the owner of a security would not let it go unless he felt it was going to decrease in value, or, unless he felt that it wouldn't increase as fast as another stock. In the same way, you wouldn't be buying unless you felt that the security was on its way up—that is, unless you just happen to enjoy losing money. The seller expects the stock to go down, you expect it to go up; only one of you can be right. Why take the chance? You don't have to.

The way to beat short-term fluctuations caused by attitudes such as those just mentioned is to invest for growth; take advantage of the trend of the market. If the trend is generally upward, you will be safe, and temporary ups and downs will average out. But if the general trend of the market is down, you had better not invest your money at all, no matter what method you use. The approaches discussed in this article are good for a "bull" market only. Now, a bull market is not a livestock exchange, it is an expression that means the trend of the market is upward. A "bear" market is one for which the trend appears to be downward. Sounds like a zoo doesn't it? Of the two methods we will discuss, let's take mutual funds first. In the next issue we'll cover the more complicated sounding "dollar cost averaging".

Suppose that you and a friend had \$100 apiece, and you decided to put your money together and buy stocks with it. If you do, you have formed a mutual fund; that is, a fund has been established to which you both contributed mutually. At first, your total assets are \$200. Assume, however, that an upward trend in the market appreciates the value of your investment to \$300. Since the original contribution was on a 50-50 basis, you each have claim to one-half the value of the total assets; therefore, you each own an interest worth \$150. This value of \$150 is called the *net asset value* of the fund. In all cases, it is computed by dividing the total assets of the fund by the number of shares or claims outstanding.

Perhaps now, you and your partner are heady with your recent success and decide to expand operations by allowing another person to buy into the fund. What price would he be charged for his share?

It is ordinarily the policy in mutual funds that all owners of a fund share equally. You may want to run your fund differently, but let's assume that you conform to custom. This being the case, each member in the fund will now have claim against one-third of the fund assets. If the new partner is charged \$100, (one-third of the funds present assets and also the same investment you and your partner originally made), his contribution would increase the total assets of the fund to \$400; now each of you have a claim to \$133.33. That is to say, your investment has been diluted by allowing the new partner to buy his share at \$100, since your investment was worth \$150 before the transaction. No doubt you and your original partner would take a dim view of this result.

Let us then assume that the new partner "buys in" for \$150, the net asset value (NAV). His contribution now increases the fund assets to \$450, and each share will be worth the same value as it was before the transaction: \$150. Each of the original partners has preserved his position in the fund by charging the new member the NAV for his share. For the present time, nothing has been gained by admitting another partner, except the fact that the fund has more capital to invest.

Finally, let us assume that the new member is charged \$200 for his share. This price is in excess of the NAV. The fund assets are increased to \$600 and each share is then worth \$200; the original partners have made \$50 on the transaction. Notice, however, that the third partner invested \$200 and has claim against \$200 of the fund assets; if he invests the NAV, \$150, he has claim against \$150 of the funds assets. In both cases, his claim is the same as his investment; he would, therefore, probably be discouraged by having the old partners make a profit from his investment. For this reason, most funds charge the NAV to buy in. Likewise, the NAV is the price paid for a member's share in the fund when he wants to sell it.

The type of fund just described is an *open-end investment company*, or mutual fund as it is popularly called. It has this name because the number of shares that can be issued is unlimited, and a share is created everytime a new member wishes to enter. The share is retired when one wishes to sell. Contrast this to a corporation

where the number of shares the business is allowed to issue are fixed by the corporate charter and can not be changed except by an amendment to this charter. Assuming that all the authorized shares have been issued, a person can not buy this stock unless another person is ready to sell. Likewise, a person can not sell his shares in the corporation until he can find a buyer. Because of the unlimited share feature of a mutual fund, this is not the case; a person can sell and buy at anytime he wishes. One other characteristic of mutual funds is the fact that you buy your share from the mutual fund itself; when dealing in corporate securities, you must buy from another investor. The same is true when you sell. We see that it is generally easier to buy and sell mutual fund shares than corporate stocks. This is a definite advantage if a sudden emergency should arise that would force you to sell some of your investments to obtain money. If you owned a corporate security, you might have to sell it at something less than its market value in order to attract a buyer right away.

Up to this point, the discussion has been concerned with open-end investment companies. There is a second type, and this is called a *closed-end investment fund*. It differs from the mutual fund because the number of shares outstanding is fixed just as it is in a corporation. Hence, you can not sell until you find a buyer, or buy until you find a seller. The "end" of the company's shares are "closed" or limited. These shares are traded on the stock exchanges just as corporate securities are traded.

Theoretically, the shares of a closed-end company should sell at the NAV also. But it doesn't always work out this way. Let's see why.

Since the number of shares in the closed-end company is fixed, you will have to buy from another investor; this will most likely be done on the open market in same manner discussed previously. (The Mechanics of Investing, Mechelecv, March, 1959.) For this reason, the stock of a closed-end fund is subject to the same fluctuations that affect corporate securities: investor psychology. There may be cases where investors feel that the share price is too high and will only offer to buy at a discount. At other times, they feel that the shares are worth more than the NAV reflects and offer to buy them at a premium. In general, the share price is not the NAV.

Traditionally, closed-end investment company shares sell at a discount. Hence, you may buy a share for \$4 when the NAV is \$6. Don't think this is a bargain, for when you attempt to sell, you will probably have to offer the same discount to the new buyer. Should a contingency arise that requires you to sell right away, you may have to decrease your asking price below the market value in order to attract a buyer quickly.

Let us next discuss a subject that is dear to everyone's heart: fees. The commission on a purchase of shares in an investment company is usually around 8% as compared to the 1½% you pay when stocks are bought directly on the Exchange. The justification for these high rates will be covered later when advantages and disadvantages of investment companies are discussed. It

should be apparent, however, that investments at 8% commission must be for a long term or else you will just be wasting your money on fees. Generally, there is no charge when shares in a mutual fund are sold; however, if you trade in and out of different funds, either you or your money won't last long. One should plan, therefore, to invest regularly with the idea in mind that he will not sell unless the fund becomes financially unsteady, or unless an emergency absolutely requires him to liquidate. His attitude towards money invested in the fund should be the same as that money he has invested in life insurance. Most people will make extreme sacrifices to keep insurance payments up to date; this doesn't infer that purchases in funds should be continued in trying times, but as you wouldn't cash in your life insurance, you shouldn't, in most cases, close your mutual fund investment. This assumes, of course, that you have some intention in the distant future of liquidating the fund for retirement or other reasons.

The charges on purchases of mutual funds are applied in two ways. One application is the *level-charge* type in which the commission is taken out of each purchase, the second is the *prepaid-charge* or *front-end load* as it is sometimes called. This front-end load is at times so devastating that we had better discuss it in more detail.

Suppose that you and your broker draw up a plan whereby you will invest \$10 every month for ten years. This means that you will have invested \$1200 at the end of the tenth year. The charge for this program, assuming an 8% commission, will be $\$1200 \times .08 = \96 . If the plan includes that the commission will be loaded in the front or prepaid, this means that all commission charges must be paid first and will, therefore, be taken out of the "front" payments. Your first nine payments and \$6 of your tenth payment are used to satisfy the commission charge. If an emergency occurred after 12 months that forced you to stop payments and close your investment program, you will have invested \$120 in the fund; but subtracting the \$96 that you paid for commission charges, you could only sell your shares for \$24! Remember, you won't get any commission payments back. Furthermore, it is possible that the program might have to be ended at a time when you would get absolutely nothing for your shares! Stay away from front-end loaded funds; it's much too risky.

By now, you should see the advantage of open-end funds to closed-end funds, and the advantage of a level charge to a front-end load. Remember that an investment company is one which sells shares and uses the proceeds to buy corporate securities. If you purchase these shares, you have ownership in the investment company; only indirectly do you own the corporate securities.

Why should you buy stock in a mutual fund when you can buy the corporate securities yourself and cut the "middleman" out altogether? That's a good question. Let's answer it by stating the advantages and disadvantages of buying mutual funds.

The average investor has neither the time nor the temperament to watch more than five or ten

(Please turn to page 23)

A Matter of Principle

by Bob Moore

Dear Sir:

I am sure that you will be greatly surprised when you receive this letter. You probably feel that the occasion of our last meeting ended on a rather final note and that there is nothing more to be said. From your point of view, this is probably true, but I assure you that from my point of view, this is quite false. If you will bear with me, I will explain my reasons for this statement.

When we last met, it was for the purpose of making a decision; one which I am sure you will agree was of great concern to me. However, I was given no voice in this decision. It was made by you and a group of my equals. As you recall, the question before you was a question of right and wrong. You were called upon to decide if a certain action of mine was right or if it was wrong. You made this decision, and I am sure that you made it in good faith. I am sure, however, that you will agree that your decision was not completely objective. It was obviously a result of your definition of right and wrong, and it is this definition that I wish to discuss.

Right and wrong—two of the simplest words in the English language, and yet two of the most important. In fact, I maintain that these are the only two words that are of any importance. The entire life of man is governed by them in the final analysis and by nothing more. Animals are governed by a similar creed, but in their case right is what instinct tells them to do, and wrong is what instinct tells them not to do. This brings us to the important point. What is the basis of this instinctive right and wrong? It is self-preservation—the greatest instinct of all! This, and nothing else, determines the actions of all living things that are capable of action. It is upon this premise that I base my entire argument: the premise that for an individual self-preservation is the only basis upon which right and wrong can be decided.

I am quite sure that you, as a reasonable individual, agree with the logic of this statement. I am equally sure that I have anticipated the counter-premise which is running through your mind as you read these lines. It is this: the decision that you were called upon to make was not one of individual right and wrong, but instead a decision of right and wrong within the context of Society. You no doubt feel that the line of division between these two types of right and wrong is clearly and sharply defined. I agree that in the minds of most individuals this is probably true. However, I maintain that this sharp line is entirely artificial and entirely false. It is founded on the ridiculous belief that a system of Society can be established on the basis of normalcy and still deal fairly with extraordinary situations such as mine! Such a belief should

play no part in the thinking of an intelligent man.

Now you are probably thinking that I feel Society, and civilization along with it, should be thrown on the junk-heap of Mankind. This is not my position at all. If this were done, the chaos that would result would be more harmful to the individual than the present inadequate system. My position is this: each individual, when called upon to make a decision such as yours, should be made aware of the artificiality of the rules of Society. If this were done, then each individual would be able to make a decision which would be more truly objective; a decision which would be based upon the solid foundation of a true right and wrong, not the artificial right and wrong of Society.

Now I must pause for a moment, summarize my argument, and then show you the conclusion to which this line of reasoning logically leads. My argument is this: no definition of right and wrong, no matter how strongly it is based upon the concepts of Society, can stand in opposition to the most basic instinct of human behavior—self-preservation! No human being, no matter how civilized he may be, can react to a situation involving his life in a manner independent of this instinct. Thus I reach my conclusion. When a person is faced with a situation in which his self-preservation is involved, the matter of right and wrong is simply and absolutely defined. The right action is that which preserves his life, and the wrong action is that which causes him to lose his life. Simple and straightforward—no ifs, ands, or buts.

I am sure that you can see how this applies to my case. I was a hunted man, unjustifiably so. I had killed, yes, but in a moment of drunken rage. A single blow, and he had fallen and split his skull on the corner of the desk. So I was a killer to be hunted down and destroyed like a mad dog. In those circumstances I had no choice. I was forced to fight back with every means at my disposal. I had to get away, so I stole a car. To get by the roadblocks, I kidnapped a woman and her two children. I had to, I had no choice. Once I was past the roadblocks, there was no alternative but to kill them. If I had let them go, they would have told the police where I was. That would have been the end! You must see that there was nothing else that I could do; it was their life or mine. It was self-preservation, pure and simple.

Well, you know the rest of the story. They caught me and brought me to trial. I was sentenced to death, and now I sit here in Death Row waiting for the sentence to be carried out. But I couldn't let it end this way; I had to make someone see that I had no choice. I had to kill that woman and her two children. Since I couldn't

(Please turn to page 24)

SHOULD ENGINEERING JOURNALISM BE YOUR GOAL?

by Keith Henney

About the author: Keith Henney was born in McComb, Ohio, on October 28, 1896. He graduated from Western Reserve in 1921, spent 1922 at Harvard University, and in 1923 joined the technical staff of Western Electric Company, returning to Harvard in 1925 to get his Master's degree.

He has written a book, "Principles of Radio", now in its sixth edition and has been the editor of *ELECTRONICS*, *NUCLEONICS*, and *PHOTO-TECHNIQUE*. Furthermore, Mr. Henney has edited the "Radio Engineering Handbook", "Handbook of Photography" and published "Electron Tubes in Industry", now in its third edition, and "Color Photography for the Amateur".

Among his other credits, he is a Fellow of the Institute of Radio Engineers, a Fellow and past President of the Radio Club of America, Associate of the Photographic Society of America, a member of the Harvard Club of New York City, and a consultant to the U. S. Atomic Energy Commission.

At the present time, Mr. Henney is a general consultant in editorial matters to both the McGraw-Hill Publishing Company and the McGraw-Hill Book Company.

There is a great deal of talk these days about the necessity and difficulty of "communicating" with other people, or so telling your story, whatever it may be, that it gets across. And because articles about our expanding engineering and scientific developments must be communicated to other technical people, the opportunities in engineering and other science journalism are continually expanding.

There are two general aspects to the field of technical communication. First, there are the opportunities within the engineering company where one works. The advantages of being able to prepare a report on one's activities tersely, clearly, and logically are numerous. Why? For the simple reason that the boss and the people up the line will easily learn what the writer is talking about and will quickly get the impression that he knows his stuff. The advantages to the engineer who contributes articles to technical journals are equally great. Such contributions enhance the professional standing of the writer; they get his name in print; they get his company's name and products before the public.

Second, there are many opportunities for the engineer-editor as a staff member on one of the many engineering and business magazines now serving all industries. And because the writer of this article has spent over thirty years in this field, and has enjoyed virtually every minute of it, most emphasis here will be on this aspect.

Now it must be said, in fairness, that there are fewer jobs as engineer-editors than as straight engineers, but they are somewhat like streetcars after midnight—there are fewer of them, but they go faster!

A single great publishing house, McGraw-Hill, employed at last count 588 editors, of whom 520 are editors on engineering or business magazines and 68 work in news bureaus all over this country and abroad. These men (and a few women) produced 48,000 editorial pages in 1956 and over 50,000 in 1957. They traveled over 3 million miles in 1957 to make 52,000 plant and office editorial visits. Of course, there are other great technical magazine publishing houses besides McGraw-Hill, not to mention firms specializing in technical public relations, industrial advertising, and technical writing.

Now how do these engineer-editors spend their time? How do they earn their salaries? Their work varies from day to day, but fundamentally their job is to gather technical material about significant industrial or scientific developments useful to the readers of their particular publications and to present this material so that the readers get the greatest good from it. The job may be a simple one such as persuading an engineer to write an article about some phase of his work. On the other hand, it may require the editor to interview an engineer to get the facts of a story from him. Next, he must write the story in such a way that the engineer is satisfied and the reader has learned something new to broaden and deepen his understanding of the developments in his field. Today, an editor may have to explain some new fundamental principle so that his readers will understand it and can apply the concept to their jobs. The next day, the task may be to explain how the existing equipment may be applied more economically, more reliably, more efficiently. Perhaps next, he might write an article on broad trends in the industry or field of his magazine.

While this may sound like an easy way to make a living, it is not always so. The mere job of getting a busy engineer to write an article may call upon all the editor's persuasive powers. To work with him, edit and clarify his writing so as to communicate it better to readers is often a challenging job. And to write clear and stimulating articles about an engineer's work after interviewing him at length will certainly require the editor to understand what the engineer has accomplished and to be able to get it down in words, expressively, concisely, and clearly.

(Please turn to page 25)

HISTORICAL NOTES . . .

ON THE DEATH OF STONEWALL JACKSON

by Bill Franklin

Saturday . . . Dr. Hunter McGuire cast a worried look toward the silent form on the bed and recapitulated the past weeks events to himself. While riding back from a reconnaissance of the Union lines, General Thomas J. "Stonewall" Jackson had been shot by his own men who had mistaken him for the enemy. His left arm had been so hopelessly shattered by a bullet that it had to be amputated. After the operation, however, the General seem to revive and had been in good spirits for the following week. Then an added complication had occurred: pneumonia!

The General's wife, Anna, had just arrived from Richmond with their infant daughter, little Julia. She had not been informed of the condition of her husband, but on entering his room, she saw the stub of an arm, the sunken and bony face, the labored breathing, and knew in a minute that she had lost him.

Dr. McGuire aroused Jackson with a few gentle shakes. He recognized Anna instantly, comforting her, and assuring her that he was ready to die if he must, but hoped that he would get better. The effort to talk was too much; again he fell into a stupor, regaining consciousness several more times—more assurances. Anna was worried; Jackson was dying.

During another period of awareness, little Julia was brought to see her father. A very religious man, the General prayed silently with her. When he had finished, Julia was taken away.

Sunday . . . Anna entered the bedroom and informed her husband that he must prepare himself for the worst. Assuming that he had not understood her, she repeated, "Do you want God to have his way with you?"

"Yes, I prefer it," he answered.

"Then before today is over you will be with God."

His breathing became more difficult, more irregular. Jackson told his wife that he wanted to be buried in Charlotte, but later changed it to Lexington, Virginia where he had been an instructor at the Virginia Military Institute before the war.

Many of those in the room were weeping aloud.

Noon . . . Once more Anna told the dying man that the end was near; again he challenged that he might get well yet . . . for her not to be so frightened. She bitterly wept, crying that the doctors had given up all hope.

Dr. McGuire was summoned and Jackson whispered, "Doctor, Anna tells me that you have told her that I will die today. Is that true?"

"I'm afraid so, General, I'm afraid so."

One o'clock . . . Sandie Pendleton, one of the General's aides, was admitted to the room. He commented that the entire army was praying for the recovery of their leader.

"They are very kind . . . It is the Lord's Day, Pendleton; my wish is fulfilled. I always wanted to die on Sunday."

Delerium came and went.

All eyes were turned to the bed. This same man less than two years before had been so thoroughly determined to hold his ground that it inspired General B. E. Bee to rally his beaten men with the cry: "Look, there stands Jackson like a stone wall. Rally behind the Virginians, men!" The nick-name stuck.

Those in the room waited patiently. There came muttering, babbling, loud cries from the General, and then . . . silence again. He wandered through his memory aloud; past battles, past conversations. Several wept unashamedly. Anna seemed stunned as she watched her husband living his past over when his future was so short.

It was three fifteen in the afternoon.

"Tell A. P. Hill to prepare for action! . . . Pass the infantry to the front . . . Tell Major Hawks to . . ."

Anna and the doctors quickly approached the bed and leaned over.

"Let us cross over the river, and rest under the shade of the trees."

The mighty Stonewall was dead.

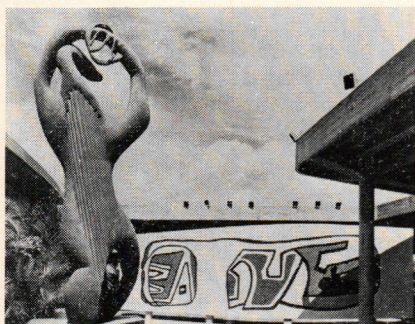
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FROM VENEZUELA:

NEW IDEAS IN ARCHITECTURE

What kind of house will you be living in by 1970? Will it sparkle with glass and vividly colored concrete? Will it be "organic", a part of its natural surroundings built from wood found within a 50-mile radius of its location? Will its bricks be in any of a hundred different hues? Will breath-taking works of art embellish lawn and interior? May the texture of its materials reflect its surroundings: rough for country living, smooth for city life? This could be. Already, in our own Southwest, you can see such homes—unusual, startling, beautiful. So much do they reflect their native surroundings, that new as they are, they seem to have always existed, to have grown along with the trees and grass that surround them.

And if you wanted a real preview of things to come, you could do no better than to visit the sleeping-giant-come-to-life south of our border, Venezuela.



Courtesy Creole Oil Co.

There, alive to new ideas, imaginative in their approach, unorthodox in their concepts, an inspired generation of young Venezuelans has fashioned a new idiom in architectural design. In ten short years, their genius has transformed a skyline of red tile roofs into an exciting composition of thrusting skyscrapers and molded concrete forms. Their pace-setting buildings are the wonder of all who visit Venezuela, and an understanding of what they have done—and why—is like gazing into a crystal ball.

To understand the nature of this architectural revolution, it is necessary to know a little about the history of the country.

Although Venezuela was discovered by Columbus in 1498, there is no "newer" country in our hemisphere. For more than 400 years Venezuela

changed very little. Then, with the discovery of oil in tremendous quantities in the early 1920's, the nation entered upon a new era. In a single generation, its economy, commerce, culture, its very way of life leapt into the 20th century. Venezuela's new architecture, more than any other visible sign, expresses this transformation.

Venezuela's architects are, consequently, more than designers of buildings. They play a unique and very important part in the solution of the social problems created in the course of Venezuela's transformation. They plan entire industrial developments; they design whole towns starting from scratch; they are literally responsible for the manner in which thousands of families live.

Because of World War II, this revolution in "design for living" was postponed. But with the declaration of peace, there took place an amazing expansion in building which has transformed the face of the nation in the short space of 10 years. Because Venezuela had no rigid architectural tradition, its architects were unhampered by "rules." Instead, they boldly faced the challenge of redoing an entire country with imagination.

If Venezuela's architecture is youthful, so are its architects. Almost all these men are young—most of them in their early 30's or early 40's. The dean and man who, more than anyone else, shaped the course of contemporary Venezuelan architecture is Carlos Raul Villanueva, who studied in France with the great Le Corbusier.

Precisely what is the nature of this "new look"? It is no less than making the country itself look and feel like its topography, climate, and raw materials!

The springtime climate of the Andean coastal range, the sweep of the plains and the high humidity and heat of the Lake Maracaibo basin have provided a widely varied environment in which the architect may work. The Venezuelan sun is incredibly bright—so bright, in fact, that a wide range of screening devices and controls had to be developed. As steel and wood are relatively expensive in Venezuela, concrete is the material most used. Venezuelans vary its hue and textures not only by coloring the material itself, but by applying bright ceramic tiles to its exterior surfaces. The result: buildings that are in perfect harmony with land, sea and sky.

(Please turn to page 27)

THE PROBLEM — TRACTION!

by Richard Byrd

The average person, buzzing through traffic in his Mushmobile Eight, is probably little concerned with what his tire-road traction limit is, mainly because his car does not have the torque available to push the driving wheels to the limit of adhesion. The only time he is likely to become concerned with the traction limit of his car is on snowy, icy, or wet roads. On the other hand, people interested in high performance automotive machinery find themselves increasingly concerned with traction limit as the performance of their machinery increases. In the sport of drag-racing (one-fourth mile, straight-line, acceleration runs) the problem becomes most acute, since machine weight is light and torque available is high. Much "back-yard" research and experimentation combined with more scientifically conducted work has been done along the lines of obtaining more acceleration through better traction.

To fully understand the traction problems involved with these vehicles, it may be interesting to note that the record speed for standing start acceleration is now over 178 mph in eight seconds! These machines have the torque available to spin the driving wheels for the full length of the one-fourth mile asphalt strip—and more. In many of them, opening the throttle at 170 miles per hour will still produce fierce wheel spin. Truly the main problem in obtaining acceleration in these vehicles is traction; the power is already there. The rule of thumb used among acceleration enthusiasts is if a vehicle has the torque to "burn rubber" for seventy-five feet or more just by opening the throttle wide with the clutch already engaged, the driver has traction problems. Efforts along the lines of improved traction will help his acceleration greatly. The owner of such a vehicle finds four factors to be considered in order to obtain maximum traction for acceleration.

The first consideration in obtaining high acceleration is one of having the smallest total weight. The largest proportion of that weight should be on the driving wheels. This basic principle, however, can be carried beyond the realm of practicality and occasionally has been. The results are a vehicle that, under hard acceleration, permits its front end to come completely off the ground, causing the loss of steering control. Needless to say, this phenomenon has caused several bad accidents. In one such case a machine had enough torque, enough traction, and a such low front end weight, that when the clutch was engaged the back wheels did not move; instead the vehicle rotated completely around them, landing upside down. Luckily, the driver escaped. Alas,

the principle of "if a little bit is good, a lot must be better" does not always hold true.

The second factor to be considered is a simple one and used almost universally. In order that traction may be obtained from both driving wheels, the differential must be rendered "undifferentiating". This is commonly accomplished by welding the *spider*, or differentiating pinion gears, to their respective shafts or by filling a tooth in one of them with welding rod. When this is done, the left and right axle shafts must turn at the same speed. Needless to say, this is not so good for turning corners, but it's great for straight-line acceleration.

The third cause to be considered is the tire-road relationship. According to one of the basic laws of physics, friction is roughly independent of area. In dealing with the situation between the tires of a traction-dependent vehicle and the surfaces on which they must travel, however, we find that the thrust which can be applied in acceleration, the vehicle is roughly *proportional* to the area of contact between the tires and the road. The first experiments using this observation were simply a matter of using the largest tires available at reduced pressures. But if carried too far, it was found at high speeds that the drag of the soft ballooning tires more than offset the acceleration gained at low speeds. Obviously, better tires had to be developed as they later were.

When the tread wears off the tires of the average person's car, he figures they are dangerous and will no longer provide good traction. The paradox is that tires yielding the highest coefficient of friction and allowing the greatest acceleration in traction-dependent vehicles are actually *treadless*. They are called "slicks", and they are just that. Now don't misunderstand and go out and buy old tires for your automobile; remember, these slicks are special purpose tires. They are good for straight-line acceleration, and in this excel; but as far as an all-purpose, all-weather tire for the average car, they fail.

The average passenger-car tire on concrete or asphalt gives a traction coefficient of around .65 to .80. In other words, a forward thrust of from 650 to 800 lbs. can be applied for every 1000 lbs. of weight on the tire. For a long time, people did not believe that the coefficient could go above 1.00; yet the acceleration obtained in special electronically timed and controlled runs indicated coefficients as high as 1.4. It is thought that the slick, soft natural rubber tires do not use friction for thrust in the strict meaning of the word. The condition existing between this type of tire and the road is known as *keying* and is analogous to a gearing rather than a friction effect.

SPEAKER DESIGNS FOR YOUR HI-FI

by J. Luis Frenk

In writing an article on speaker design and installation that is to be of interest to all engineers, theory and derivations should necessarily be limited to a qualitative basis. Furthermore, equations should be kept at an absolute minimum so as not to becloud the explanations with long, involved, and perhaps discouraging mathematics.

A more rigorous treatment of the field theory aspects of speaker design and of the acoustic considerations can be found in the references listed at the end of this article. The objective here, however, has been to inform the reader about the basic principles which govern the design and performance of those electromechanical transducers that we call loudspeakers, and of the different loading methods employed in coupling them to the air.

The most common loudspeaker type in use today is the electromagnetic unit. It is therefore fitting that we should study its theory of operation, although there are some speakers that function on different principles.

Let us consider a uniform field of magnetic flux, B , that extends radially from the point O . Now, at a radius from the point, let us introduce a loop of wire in which flows a current I . We now remember that the incremental force exerted on each segment of a conductor in a magnetic field is expressed by the vector equation:

$$dF = I \, dl \times B$$

On each segment of the loop, a force will be exerted which will push the loop one way or the other, depending on the direction of the current. If several of these loops are put in series and are held together by wrapping them around an insulating tube, the "in-and-out" motion of such a device can be controlled by the polarity and magnitude of the current that is circulated through the coils as long as there is a small restoring force that tends to keep the coils at a "no-signal" position. These current coils are called *voice coils*, and the tube around which they are wrapped is called the *voice coil former*. A device that centers and supports the voice coils is called a *spider*. Instead of depending on a point source to establish the magnetic field B , suppose the voice coils and former are placed between the ends of a horse-shoe magnet. Attach a paper cone to the end of the voice coil former, and we have a crude form of an electromagnetic speaker; the same type that you probably see everyday. The material ordinarily used in speaker magnets is Alnico V.

It now becomes evident that an alternating current, when passed through the voice coil, will cause a proportional alternating displacement in it. If the paper cone has been attached as described above, the whole structure will move in unison with a electrical signal. This large paper cone will in turn excite the air, and thus the electrical signal has been converted to an acoustical signal.

Let us next examine some of the characteristics of such a device by means of dynamical analogies. First, consider the electrical equivalent of mass, M , which is inductance, L . Also, the electrical equivalent of compliance, C_m , (the inverse of stiffness), is capacitance C . If we take a parallel LC circuit, we shall find that its principal natural resonance occurs at a radian frequency

$$W = \frac{1}{(LC)^{1/2}}$$

The performance of the speaker can be examined similarly. The mass of its voice coil, cone, supports, etc., can be called M , and the compliance of its spider, C_m . Similar to the preceding electrical analogy, the speaker has a natural resonance at a radian frequency

$$W = \frac{1}{(MC_m)^{1/2}} = \frac{1}{(MC_m)^{1/2}}$$

Now, what do we mean when we say that an LC parallel circuit is in resonance? We mean that within its elements there is a large current caused by a small excitation. In a similar manner, the resonant frequency of a speaker is the one where, for a small electrical current flowing in its voice coil, there is a large mechanical displacement of its diaphragm. As the resonant frequency in an LC circuit can be regulated by varying L and C , so may the weight of the cone, coils, etc., and the stiffness of the suspension be regulated to obtain whatever natural frequency is desired in a loudspeaker.

What of the impedance that this device presents to the driving source? With direct current in the voice coils, we can, of course, expect to find the impedance to be simply the d-c resistance of the wire used in making the coils. But with alternating current in the coils, as the frequency gets very high, we can expect that the voice coil will simply act as an inductor and that its impedance will increase as the frequency increases. Between the value of the impedance obtained with d-c in the windings and that obtained with

a-c at maximum frequency, a peak or maximum coil impedance occurs. This peak occurs at resonance, for as resonance is approached, a small input signal causes a large displacement, and consequently, the voice coil moves a large distance in a magnetic field. Now, by Lenz's Law, (the direction of the induced electromotive force is always such as to tend to oppose the change that produced it), an emf will be produced in the voice coil with a polarity opposing the signal. This back emf will cause the effective impedance to the driving force appear larger. At resonance, therefore, the motion of the coil is greatest, the back emf is greatest, and the driving force "looks into an impedance peak. As resonance is passed, the back emf decreases as does the impedance. Next, at about 400 cps for most speakers, an impedance low is reached. Above 400 cps the impedance begins to climb once more due to the inductance of the voice coil. This lowest value of impedance is the nominal impedance that is generally given for a loudspeaker.

One might very well wonder with such a variance in impedance, how we can expect anything like the level frequency response characteristic that is generally desired from a speaker. The answer to this lies in an experimentally obtained efficiency vs. frequency curve for the speaker. One will find that the efficiency peaks in the same region as the impedance: resonance. This is reasonable, since a small signal causes a large acoustical output. The following example, taken from experimentally determined curves, will prove interesting; the acoustic output at two frequencies, resonance and 400 cps, will be calculated from the curves keeping the input constant at 10 volts.

Frequency	Impedance
cps	ohms
Res.	24.7
400	5.5
Power Input (watts)	Power Output (watts)
$P_{in} = E^2/Z$	$P_{out} = P_{in} \times E_{ff}$
$100/24.7 = 4.05 \text{ w}$	$4.05 \times .065 = .263 \text{ w}$
$100/5.5 = 18.2 \text{ w}$	$18.2 \times .012 = .218 \text{ w}$

We can see that, although the impedance is far from linear, the acoustic output remains fairly constant with just a slight peak at resonance.

The selection of the resonant frequency is important in the design of a speaker, since it determines at what frequency region it will be best suited to work. Specialized speakers can be made to function particularly well at low frequencies by designing them with large, heavy paper cones and highly compliant suspensions so that the resonant frequency will be low. Moreover, their large cones will move large amounts of air per cycle, which is necessary at low frequencies. At high frequencies, since the speaker cone cycles more times during a second, less air need be moved per cycle to displace the same volume of

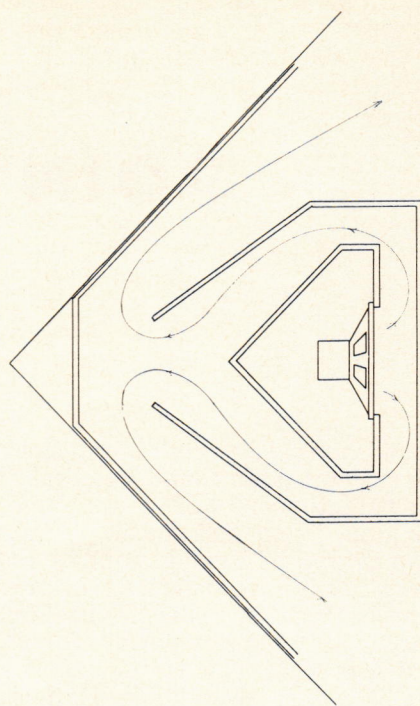
air that is displaced at low frequencies. Thus, for specialized high frequency speakers, small cones can be used. Another reason for this is that, by making the cones small and light and the suspension stiff, the natural resonant frequency is raised. The advantages of electromagnetic loudspeakers are their relatively high efficiency and ruggedness.

Up until now, we have not considered the fact that the cone of a speaker has two sides. Since the speaker cone moves in and out along the axis of the coil former, the pressure against the air on one side of the cone is a maximum when the pressure on the other side is a minimum. For instance, if the cone is moving horizontally to the left, the air on the left side is suddenly compressed and the pressure in this region increases; at the same time, the air on the right side expands and here the pressure falls. This being the case, the acoustical signals from the front and rear of the speaker are 180° out of phase. At high frequencies, where the size of the cone diameter is several wavelengths, the diffraction of the acoustical signal is small, and each side beams its output away from the other without the signals mixing. However, at low frequencies, where the cone diameter size is a fraction of the wavelength, diffraction is rapid; therefore, the signals from the front and rear of the speaker begin to mix after they have traveled a short distance from the cone surface. Since the difference in phase between the two signals is 180° , total or at least partial cancellation will result in the region where mixing occurs. This shows that an unenclosed, i.e., unbaffled speaker will be severely limited in its low frequency output. But if the rear wave is always separated from the front one by mounting the speaker in an infinite wall, there can be no interaction and consequent cancellation between the two. Since an infinite wall is highly impractical, a completely enclosed box lined with acoustically absorbent material will do the same job. The volume enclosed, however, must be large enough so that all of the back wave is smothered and absorbed by the walls, and none of it can bounce back onto the cone to disturb its motion. This arrangement produces very clean reproduction with a high quality speaker that has no sharp resonances, but it decreases the efficiency by $1/2$, since only $1/2$ of the acoustic output is used.

A different type of speaker baffling, the bass reflex, is a resonant type enclosure. Referring again to our parallel LC circuit analogy, we make use of the fact that an enclosed space has an acoustic capacitance, C_a , while a tube or opening exhibits an acoustic inductance called inertance M . If we have a closed box and make a hole in it, the air inside it will tend to have a natural resonant frequency that will be governed by the volume enclosed and the area of the hole. At high frequencies, this arrangement acts similar to the closed box, since the reflections inside the box

rapidly attenuate high frequencies. On the other hand, at low frequencies, the phase of the rear wave is shifted, much the way current shifts out of phase with the voltage in reactive circuits, and it emerges out of the hole in phase with the front wave, assisting it and extending the low frequency response. In this manner, the low frequency efficiency is increased, but the out-of-phase components created at some frequencies causes uneven response.

A third method of speaker loading is the horn. To understand its principle of operation better, let us first use another electrical analogy. Suppose a voltage source has a capacitive internal impedance, Z , and an output voltage, E . Since capacitive reactance decreases as the frequency rises, the internal impedance of this source is less at high frequencies than at low frequencies. If a load is connected to the voltage source, most of the output voltage, E , will appear across the load if the frequency is high enough to make Z negligible. This results in good power transfer. When the frequency begins to fall, however, the internal impedance increases, the voltage across the load decreases, and the power transferred becomes smaller. Obviously, this method of energy transfer is not too efficient at low frequencies. We can, however, take advantage of the fact that an impedance connected to the secondary windings of a transformer appears as the product of the impedance and the turns ratio squared at the primary. The output of our voltage source can then be connected to the primary of a step-down transformer. If this is done, the load presented to this source will be increased by a factor of the turns ratio squared. By this method, the voltage appearing across the load at the given frequency is greater than it was in the absence of the coupling transformer. Another way of stating this is that, for a particular frequency and a particular load voltage without the transformer, we can obtain the same voltage but at a lower frequency if we use the transformer; i.e., the low frequency range of the voltage source has been extended. A horn is an acoustical transformer. Since the mechanical impedance of a speaker is higher than that of free air, we find at lower frequencies, where the motion of the speaker increases, the speaker will spend most of its energy pushing against its own supports instead of the air. By funneling the air against the speaker diaphragm, forcing it to push against the directed column of air, the horn avoids this problem and matches, much as the transformer does, the low impedance of the air to the higher one of the speakers. In this manner, the speaker will be able to extend its response to lower frequencies than without the horn. Since the horn length has to be an appreciable fraction of the wavelength, a long funnel tube is not a practical design for low frequency speakers—the horn would have to be a ten-foot monster! But it can be folded within itself as shown in this sketch.



Finally, a few words about integrated systems.

Specialized high frequency speakers, matched with the proper low frequency units, can cover the whole audio range smoothly. But indiscriminate mixing of different speaker types will not yield satisfactory results. For instance, a highly efficient, horn-loaded low frequency unit cannot be used successfully with a low efficiency high frequency unit. They must be matched. Unfortunately, on integrated waveforms consisting of many component frequencies such as a square wave, the greater length of the low frequency horn will cause the low frequencies to come out a few feet behind the higher notes, thus introducing phase distortion.

Infinite baffling does not have the phase distortion problem encountered in horns, but its efficiency is very low. The response is very much dependent on the quality of the speaker in this type of baffle, since the speaker is not aided in the least by the enclosure design.

Bass reflex loading is a compromise between high and low efficiency, and it has a lesser amount of phase distortion.

All of these problems make it necessary, therefore, to take efficiency, frequency range, and phase characteristics into account when making up an integrated systems.

References:

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POINT OF ORDER

by Bill Franklin

If you had bought the rights to a gold mine in South Africa and later found out that this mine was non-existent, there would be no question but that you had been defrauded. Among other things, the Statue of Fraud requires that an injured party must have relied on information he thought to be true in order to use fraud as a defense against the guilty party. Obviously, one can't take everything he is told as the "gospel truth". This would seem to indicate that some attempt should be made to ascertain the validity of a statement before it is acted upon. For this reason, there are those who feel that a buyer dealing with a seller "at arm's length", that is, on an impersonal basis, should follow the rule of *caveat emptor*—let the buyer beware. Others, however, feel that the law should protect those who won't protect themselves. At any rate, just how far are you required to investigate a statement in order to establish that you did not rely on it blindly? The answer is not a simple one as you will see from the following controversial case.

A race horse by the name of Lucky Lady had won every contest in which she was entered. With such a distinguishing record, everyone was sure that her career would soon include entrance in the Kentucky Derby—perhaps to win again. A horse with this potential, needless to say, was quite a valuable piece of property, and several attractive offers to buy her had been refused by her owner, George Davis.

One day, however, it was announced that Lucky Lady was for sale. Of all the offers received, the most interesting had been submitted by one Marshall Harris; Mr. Harris was invited down to the stables to discuss the terms further and to sign a contract. After reaching terms that were agreeable to both parties, Harris asked to see Lady before he definitely committed himself. The two men walked out to the stables.

Lucky Lady was standing in her stall, which was about twelve feet square. On the floor of the stall was a thick blanket of hay. Since the lights in the stable were not on and there was no window in the immediate vicinity, it was rather dark inside. For a few minutes, Harris talked to the animal, fed her sugar cubes, and affectionately patted her on the neck. Then the two

men returned to the house to sign a contract of sale.

After the formalities of the sale were finished, Harris had his van backed down to the stable door and led Lucky Lady out of her stall. Once in the sunlight, he noticed a cast on the shank of the horse's front right leg; subsequent investigation revealed that the leg was broken and that Lucky Lady would never race again. Harris sued to rescind the contract.

During the trial, the above facts were brought out, and Harris further emphasized the fact that the stable was dark and there was a large quantity of hay on the floor of the stall, concealing the cast.

If you had to decide this case, would you enforce the contract between Harris and Davis?

Harris lost; the contract could not be rescinded. The Court felt that the buyer entered into this deal with his eyes open, having full knowledge of the horse's value and the reluctance on the part of Davis to sell in the past. It was further decided that a prudent man would have led the horse outside, or at least examined her superficially, for this would have taken no great effort, expense, or time.

No; the moral to this story is not that you shouldn't buy horses in dark stables. But when you buy something, especially when a large amount of money is involved, you should make some attempt to see that everything is as it should be—particularly if you have any reason to be suspicious. This does not require you to go to any expense or time-consuming investigation; it does require that you go into a sale with your eyes open. Example: if you buy a car, make sure it will run and demand evidence of ownership; if you buy a house, a few minutes and a telephone call will reveal if there are any prior liens, easements, reservations, or other encumbrances to the property title. It is better to be safe than sorry.

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A QUICK WAY TO SHORTHAND

by Ted Pollock

If you've ever left an interview with a prospect and wished you could jot down the high points as swiftly as they tumbled through your brain . . . or been confronted with half a dozen pages of specifications to copy when your next appointment was just minutes away . . . or attended a sales meeting where money-making ideas flew thick and fast—then you are familiar with just a few of the many occasions that make an agile pencil literally worth its weight in diamonds.

Many salesmen, discouraged by their inability to take notes quickly, too often rely on memory. Results: embarrassing oversights, precious time wasted in checking back, even lost sales.

To the rescue: a "quickie" training course in practical shorthand that can be mastered in about half an hour. Based on the techniques used by reporters who, like salesmen, seldom know any of the standard shorthand systems, this "Salesman's Shorthand" can increase your writing speed by 40-50 per cent. Anyone who has ever suffered through the "agony of recall" can set his own price on its value.

There are just seven rules:

1. *Abbreviate.* Almost every word in the English language can be shortened. Vowels in particular may be omitted. For example, "Satisfied customers have made our reputation" may be abbreviated, "Stsfd custs hv md r rep." With practice, you will find that it is easy to train your mind and hand to deal only with the skeletons of words.

2. *Leave out unessential words.* It is seldom necessary to take down a word-for-word transcription of a conversation or lecture. Our daily speech is peppered with frills that, while flavorful, are meaningless or unimportant. Take the following excerpt from a speech:

"I, for one, agree that the salesman's right arm is advertising in all its varied forms: newspapers, magazines, radio, television, direct mail and circulars."

None of the meaning is lost in this version, which is only one-third as long:

"Slsmn's rt rm is adv: paprs, mags, rad, TV, dir ml & circls."

3. *Take advantage of natural abbreviations.* Look at the keys on any typewriter and you will find a host of abbreviations and symbols that can help you cut your writing time. The use of digits instead of words to express numbers goes without saying. But there are other symbols that can save time, such as $\frac{1}{2}$, $\frac{1}{4}$, # (number), %, \$, c, @.

Because of their pronunciation, certain letters and numbers may be substituted for common words: *b* (be), *r* (are, our), *u* (you), *2* (to, too), *4* (for).

And don't overlook the convenience of such old abbreviations as *i.e.* (that is), *e.g.* (for example), *c.* (around, about, approximately), *ibid.* (the same).

The sentence, "Product knowledge has a dollars and cents value for you, too," can be shortened, with these natural abbreviations, to "Prod knowlgs a \$ & c val 4 u, 2."

4. *Abbreviate suffixes.* There are several common word endings in English, like -ive, -al and -ment. By adopting abbreviations for the most common ones, you can appreciably reduce writing time. The following are suggested: *v* (-ive, -ative), *l* (-al, -ical, -ogical), *mt* (-ment), *bl* (-able, -ible), *—* (-ing). You can make up others to suit your own vocabulary. Thus, "Creative selling is not always logical selling" may be written, "Crtv sl— nt alwys logl sl—."

5. *Adopt a system of letters for common words.* According to the Handwriting Foundation, less than 100 words make up 50 per cent of the average speaking vocabulary. If you can devise a system of letters for the most common nouns, pronouns, conjunctions and prepositions, you have half your problem licked. Many reporters use the following: *o* (on), *f* (from), *w/* (with), *w/o* (without), *xc* (except), *nst* (instead), *bc* (because), *h* (he), *w* (we).

Example: "He failed because he thought of himself instead of his customer. Without empathy, we salesmen are doomed." In "Salesman's Shorthand": "H fald bc h tht of hmsf nst of hs cust. W/o mpthy, w slsmn r dmd."

6. *Borrow from the phonetic alphabet.* Students of language have devised a series of symbols to represent the sounds we make when we talk. Two of those symbols can be particularly helpful to the salesman who is pressed for time.

The first is the \int . In phonetics, this symbolizes the "sh" sound. For purposes of note taking, however, it stands for the "-shun" sound as well.

(Please turn to page 27)

If I Had One Last Lecture to Give

When asked what he would discuss if suddenly informed that he could give only one more lecture to his students, "Deacon" Ames responded with this interesting article.

MY LAST LECTURE

by Dr. Norman B. Ames

Professor of Electrical Engineering

The mere contemplation of my last meeting with students in the class-room stirs me with mixed emotions—that of relief from a routine that has dominated my life for many years, that of genuine loss through the termination of associations with "my boys", and that of responsibility for some word of encouragement to you to feel the significance of the work you shall do as engineers.

There have been many advances in engineering and engineering education during my time; there will be many more during your time. There will be increasing emphasis on theory; particularly in mathematics, physics, and chemistry; and engineering, as such, may suffer a loss of prestige. Science is the keynote in the frantic competition for supremacy and even survival. Leonardo da Vinci said: "Science gives certainty and science gives power. Those who rely on practice without science are like sailors without rudder or compass." This is particularly true in the "Space Age" today.

But sound and time-tested practices must not be discarded, especially those of engineering, and this is the responsibility of the engineer. Someone must remember that electric power is the lifeblood of industry in every developed nation of the world. "Electric power is an intangible translated into terms of flesh and blood. It activates the vast web of technology in which modern man finds himself."* Electric power depends upon the development of natural resources of coal, oil, gas, water, and fission fuels. Conservation of these resources is imperative if ours is to be a survivor nation, certainly until fusion is an accomplished fact.

There will be an increasing need for real sanity in the future frenzy. How silly it is to talk about traffic controls in outer space while imperfectly controlled traffic on the earth now kills thousands. And how foolish it is for a nation to kill itself with radio-active fallout while planning to kill an enemy.

The Russians early realized the need for technicians and began training them—about six to eight for each engineer. Plans in our country must be accelerated for the training of technicians so that engineers may be effectively used in critical work.

You have already been discouraged many times and will be discouraged many times more when problems, reports, and exams loom ahead of you. Having been a part-time student myself, I have a natural sympathy for the student who is willing to make a sacrifice to improve his or her mind while supporting himself and, perhaps, a family. Remember the adage, "no one ever failed but many gave up too soon." Remember too, the words of Hans Christian Oersted: "The Universe is a manifestation of an Infinite Reason, and the laws of nature are the thoughts of God."

A final word: Be diligent in your efforts, have faith in yourself and your fellowman, and pride in your profession.

"A tired old doctor died today, and a baby boy was born—

A little new soul that was pink and frail, and a soul that was gray and worn.

And halfway here and halfway there

On a white high hill of shining air—

They met and passed and paused to speak

In the flushed and hearty dawn.

The man looked down at the soft, small thing, with wise and weary eyes;

And the little chap stared back at him with startled, scared surmise,

And then he shook his downy head—

"I think I won't be born", he said;

"You are too gray and sad!" And he shrank from the pathway down the skies.

But the tired old doctor roused once more at the battle-cry of birth,

And there was memory in his look, of grief and toil and mirth,

"Go on!" he said, "It's good—and bad;

It's hard! Go on! It's ours my lad".

And he stood and urged him out of sight, down to the waiting earth."

Harold Francis Branch

*Connor, Cross, Evans and Tannebaum: "Electric Power and Social Policy"; Columbia University, 1951.

• • •

THE MECHELECIV

COMM LAB

By Melvin Strud

Well, here we are for another miserable three hours. I guess I'll miss the Late Show again. Which one of us was supposed to read the experiment?

I was.

Did you read it?

No; Funny Bunny, I punched holes in the paper and felt it like Braille. Of course I read it.

Well, let's get started. I think this is Experiment No. 3.

Let's flip for a Pepsi.

Not now, Clunk, we've only been in here for ten minutes.

What's that experiment over there?

It's something to do with a waveguide.

You mean that little thing is a waveguide? How do you get the water into it? Hey!—what are you doing?

I'm sticking my finger in your ear to see if it comes out the other side.

You're so dang much in a hurry, let's get started.

O.K.—turn on the power.

There. Now let's flip for Pepsis.

Wait a minute, Mushbrain, I like to get one experiment finished before I graduate from this place.

You know, I heard that the day lab instructor graduated from the State Penn.

Penn State, you Clod-buster!

I always get everything backwards.

Turn that dial over there until I say stop. Hey!—watch what you're doing—that's my nose you're twisting. What are you looking at?

That tall Greek fellow over there.

What makes you think he's Greek?

His name is Psi Matthews. Hey!—get your finger out of my ear.

All right, Young Tom Edison, I'm going to increase the voltage and you tell me what the current reads.

Keep going—keep going.

What's the matter now?

I think you better decrease the voltage.

Why?

The needle on this meter is bent around the peg.

How did you ever get in this school?

Let's break for Pepsis.

Let's break your head open and see if there is anything in it.

Do you want me to do anything else?

Yes; you can take down the data. You can write, can't you?

Now hear this. Now hear this.

Hey Stupid! Get away from that transmitter and come back over here where you belong.

Now hear this. Break for Pepsis.

I get the impression you're not interested in this experiment.

I get the impression that you don't like Pepsis.

Do you think you could pick up that coil and see what its rating is?

It says on here . . . 3 henries. Who's Henry?

Gimme that dang thing! Now the scientific approach to this is to actually measure the inductance, rather than assume this value is correct.

I'm with you all the way, Aristotle.

Good. You go downstairs and measure this inductance on the bridge.

Is that in the C.E. lab?

Let's break for Pepsis.

Yea!

Now go measure that inductance while I finish step No. 1.

O.K. To get Pepsis I will go, to get Pepsis I will go, hey-ho the merry-o

Well, it certainly took you long enough; you were gone an hour.

Here's your Pepsi.

Thanks half to death. Did you measure that inductance?

Yes.

What value is it?

3.000 henries.

Oh fine! What time is it?

Two hairs past a freckle.

What!

I don't have a watch.

You don't have a brain either!

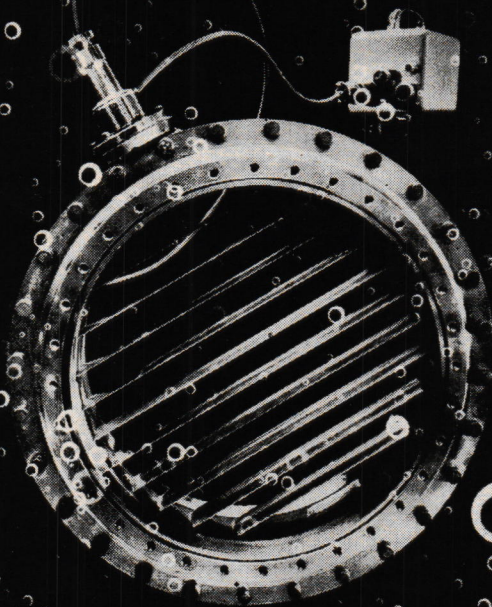
Hey!—I got feelings, you know.

Well, here's one more experiment that we didn't get past turning the power on.

Don't feel so bad. I hear that this is just technican work. It's the theory that counts!

• • •

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THE MECHELECIV



NEWS IN INDUSTRY

REACTOR INFO: A new book of nuclear reactor information, including data specially declassified for this publication, has been announced by the American Society of Mechanical Engineers. *Nuclear Reactor Plant Data—Research and Test Reactors* contains detailed information on 95 reactors in the United States, Canada, South America, Western Europe and Asia. Test facilities covered in the book range in production from almost nothing to 175,000 kilowatts of power and cost from a few thousand dollars to over fifty millions to build. For each reactor, general information, such as type, designer and operating schedule, is first listed, followed by cost, status, fuel, coolant, control, research facilities, bibliography and a detailed diagram of the reactor. The information, according to the editors of the work, is the latest available. Price of the book is \$7.50. It is available from the Order Department of the ASME, 29 West 39th Street, New York 18, N. Y.

OPTICAL GLASSES: Special light-weight optical glasses with high refractive indices and high dispersions have been developed by the National Bureau of Standards. Because of their optical properties, these glasses may be used as elements of compound lenses, particularly in applications such as aerial photography and periscopes where a wide field of view with minimum distortion is essential. In such systems, elements of these glasses would be advantageous for eliminating astigmatism, coma, and chromatic and spherical aberrations. The low densities of the glasses make them especially suitable for use in aircraft where weight is of prime importance.

ATOMIC BATTERY: The world's first atomic battery, unveiled recently, marks a new concept in power production. With this device it now becomes possible to produce power for long periods of time without conventional batteries. The battery's power plant is fueled with radioactive

polonium-210 which is utilized as a heat source. The polonium is housed in a stainless steel capsule which is encased in a molybdenum container. The power output is rated at five watts when it is fully fueled. It will generate half this wattage after 140 days, then half again for the next 140 days, and so on until the polonium's useful life is exhausted. Efficiency of the unit is rated at 8 to 10 per cent, far greater than any other known thermocouple device developed to date. Since there is no way of changing the decay rate of a radioisotope, the power output cannot be shut off. Atomic Energy Commission officials estimate that during a 280-day period the atomic device, which weighs a mere five pounds, will put out the same total power as that produced by 1450 pounds of top-notch conventional batteries. Cost of completely refueling the unit with 3000 curies of polonium-210 runs about \$30,000. Researchers are now studying the radioisotope cerium-144 from the standpoint of cutting fuel costs.

INSTRUMENT RENTAL: Science and engineering instructors in schools and colleges now have a new and inexpensive way of obtaining a variety of instruments for demonstration and experimentation. The General Electric Company has announced establishment of a pool of 13,000 instruments which it will rent in the first large-scale, nationwide rental program of its kind. Organized through the company's cross-country network of 55 Service Shops, the new program offers instruments for more than 70 different kinds of measurement at monthly rental fees ranging from \$1 to \$96. Average monthly rental cost is \$16. The devices available range all the way from a \$2,500 multipoint temperature recorder to a pedometer to measure the distance an individual covers on foot. Other rental instruments include microscopes; numerous recording devices and other instruments which measure virtually every electrical or mechanical quality;

special instruments such as leak detectors, temperature gages, flowmeters, pressure recorders, and thousands of other measuring devices in more than 200 different "families" of instruments.

FUEL CONTROL SIMULATOR: Aviation gas turbine engineers have designed and built an electronic analog device, called a fuel control simulator, that controls fuel flow for extensive testing of new jet engines to obtain necessary engine data for ultimate fuel-control design. A variety of fuel schedules and fuel control constants can be set to obtain optimum engine acceleration and deceleration as well as steady state operation for the full operating range of the engine (i.e., altitude, temperature, and flight speed). Using the fuel control simulator, adequate engine mapping can be accomplished with approximately 50 hours of engine running, while conventional testing to acquire equivalent data would require about 200 hours of engine running. Future applications of this unit will further decrease development time and costs, and allow better matching of fuel control designs to individual engine designs.

RADOMETER: The Radometer is a new device developed for measuring x-ray dosage to a patient. The device consists basically of an ion chamber, a capacitor, and an electronic electro-

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meter and meter-relay, with the necessary power supplies. The ion chamber is placed between the x-ray tube and the patient. The ionization produced in the chamber by x-rays is proportional to the radiation dosage to the patient; the ions produced in the chamber are collected and applied to charge the capacitor. The charge on the capacitor is transformed by the electrometer circuit to a reading on the meter-relay. The meter-relay has a pointer that can be set to any spot on the meter scale by an external knob. When the x-ray dosage causes the indicating needle to reach the pointer, a contact is made that energizes an alarm and, if desirable, terminates the x-ray exposure. The device can be applied to any case where fixed x-ray tube-to-patient distances are used, such as fluoroscopy, spot-film radiography, and cineradiography.

ULTRASONIC SEAM WELDER: An ultrasonic seam welder that can weld sheets of dissimilar metals continuously has been developed by engineers of the Westinghouse Company. This welder brings to seam welding the advantages of ultrasonic welding: it makes dissimilar metals weldable, and eliminates the need for surface preparation prior to welding. Although the welder is still in the development stage, with some refinements it could have great practical value. The continuous ultrasonic welder works something like this: sheets of metal to be welded are passed between two wheels vibrating at 20 kilocycles per second. The peripheries of these wheels press against the metals on opposite sides of the sheets. At the point of contact, the wheels break up the oxide coating on the metal surfaces and by a kneading action weld the metal lattices on the surfaces of the metals themselves. No electric current is passed through the spot being welded although in appearance the ultrasonic seam weld is similar to an electric weld. A variable-speed drive moves the metals through the unit as the weld is completed by means of the vibrating wheels. With the experimental welder that has been developed, two sheets of aluminum 0.010-inch thick have been seam-welded continuously at a rate of 15 inches per minute. Investigation is continuing on the ultrasonic seam welder to increase the welding speed, and to increase the thickness of the metals that can be welded.

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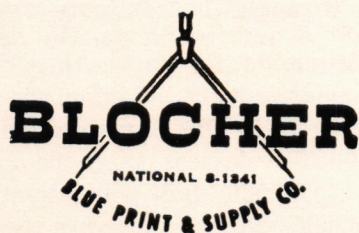
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MUTUAL FUNDS

(Continued from page 7)

different securities. If one of these investments suddenly fell in value, the loss could be crippling. A mutual fund, because it has large amounts of capital contributed by its many stockholders, can diversify. This means that the managers of the fund invest money in hundreds of companies; losses occurring on one, or even several of their investments will be almost insignificant. One advantage of mutual fund investment, therefore, is diversification.

Mutual funds are able to provide professional management. When you buy a share, your money is handed over to the company to invest as it sees fit. A staff of highly trained people spend money and time researching the investment field for the best "buys" and, in turn, indirectly make this knowledge available to you when they put your money to work. The average investor could not possibly have the time to seek out these "buys" himself, or the ability to manage them as efficiently as a full-time financier. Full-time professional management is then the second advantage we find in mutual fund investment.

The last advantage concerns fees. You could not hope to pick securities for your investment program that would all turn out to be good ones. One or two of them may cease to appreciate or even begin losing value and would have to be sold. These should be replaced with other securities, if you are to keep all your investment capital working for you. Do this many times, and the 1½% commission that you are paying to buy and sell your securities will eventually amount to more than the 8% you pay to buy mutual fund stocks. (Remember there is usually no charge to sell shares held in the fund.) There still remains the restriction mentioned before; an 8% commission is a high price to pay for a short-term investment.

What are the disadvantages of mutual funds? This point is as controversial as deciding whether the chicken or the egg came first. The big disadvantage seems to be investor complacency. It's pretty easy to just put your money in a mutual fund and forget all about it. Granted, mutual funds require less attention than investments in corporate securities, but nothing, yea, nothing that takes your money away from you is worth forgetting. The same idea applies to those people who don't invest in mutuals because they aren't as much fun as investing in corporate securities; this can sometimes be expensive fun. It is certainly true that a person does not get as much investment experience buying mutuals, but everyone must learn to crawl before they walk.

Select a mutual fund that has definite promise, invest in it at regular intervals, supplement it with life insurance and the purchase of corporate securities if you wish, and when age 65 rolls around, you'll be sitting fat and happy.

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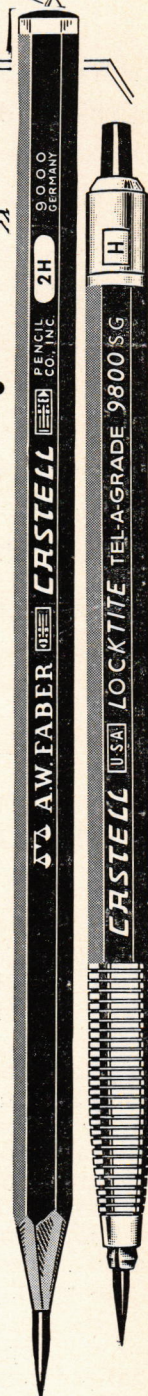
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MATTER OF PRINCIPAL

(Continued from page 8)

hope to make the whole world understand, I decided that I would at least try to make you understand. I had no choice!

When I said earlier that you and a group of my equals made the decision, I was not entirely correct. The decision of whether I should live or die was made by a group of my equals, the twelve men and women of the jury. You were not even a member of this group, but I could tell from watching you at the trial, that you had reached the same decision as the others—the decision that I was wrong.

But I hope that because of this letter you have changed your mind. I realize that this is a great deal to ask of you, since the woman I killed was your wife, and the two children, your children. But I hope you understand. I had no choice; I had no choice

• • •

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ENGINEERING JOURNALISM

(Continued from page 9)

Thus, there are many challenges for the engineer-editor on a big league journal. No day's work is like any other day's; no two articles are alike. But everything the editor has learned, technical or not, will be useful to him; his opportunities for mental growth will never cease, and it can be tremendous fun. His interests and acquaintances will run the whole gamut of any special field; all doors will be open to him. Engineers who wish to publish will seek him out, and companies wishing to get their name and products before the public will cultivate him. His own knowledge is continually expanding. He becomes a sought-after speaker on trends and developments in his field and is asked to participate on many professional committees and panels.

What is required to be a good engineer-editor? If the prospective editor has had some actual industrial experience, he will find it of great advantage. It will give him a better feel for his job, and he can draw upon his first-hand experience in talking with engineers and translating their work to the printed page. If he has acquired the ability to write good technical reports within his own company, if he has published an article or two in his chosen journals, then he has already demonstrated the ability to communicate, and his value to the periodical on which he will carve out his future will be apparent.

Certainly such a man must have kinship with the readers of his magazine. He must have a good working knowledge of his industry's tools and how to use them, of his industry's technical and economic problems, of trends in his industry or field. He must have the imagination to recognize a story when he sees it in a very embryonic state and to gather the essential facts and data so that a useful article will result. And he must have the ability to write and illustrate the final article.

In other words, a good engineer-journalist is a good engineer capable of understanding what other engineers are doing. And he's a good writer capable of explaining to thousands of engineers the accomplishment he has uncovered. He must know how to get along with people so that he can find out what his readers need, so he can go out into the field and dig out the raw material that gives the articles substance. He must have a basic interest in what engineers are doing, in what's happening within his field or industry, and a basic desire to describe and communicate this for the benefit of all concerned. If, in addition, he can make good sketches or good photographs, if he has an acute sense of news and can invent new ways of presenting the technical material in words or pictures, he has the tools of the profession. He is on the road to an exciting and rewarding career.

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TRACTION

(Continued from page 12)

Slicks are very wide tires and tread widths go up to nine or ten inches with contact areas around eighty square inches or more per tire. When uninflated, the tires are concave across the tread, but when inflated, they are flat, rather than rounded as an ordinary tire is. They are mounted on extra wide magnesium rims, since magnesium is light and also grips the tire bead better than steel does. More than one driver has opened the throttle on a "hot" machine equipped with slicks mounted on narrow steel rims and had the rims spin inside the tires. This further resulted in pulling in the air valves and tearing the tubes up; a very embarrassing situation. To prevent this, the difference between the rim width and the tread width should not be greater than one inch.

The fourth consideration is the skill of torque application, i.e., the method of driving. Ideally, maximum acceleration should be obtained if the tires are pushed just to the limit of static friction. This is, however, impossible to do in practice. The driver is then faced with two choices. He can try to accelerate below the static friction limit by

going easy on the gas at the expense of not applying the maximum possible torque, or he can "pour it on", letting the wheels spin, and thus pass into the dynamic friction region where the friction coefficient is lower. Each case has its proponents, but the best results are obtained when the wheels are allowed to spin slightly faster than the vehicle speed. This takes precision throttle control and requires much practice and experience. Furthermore, the coefficient of friction will drop off as the tires get hot, so that spinning too fast will cause excessive heat, reducing the traction and hence the acceleration. When attempting to leave the starting line rapidly, inexperienced drivers will sometimes rev the engine to a high rpm and "pop" the clutch. The wheels go 60 mph and the car stands still in a cloud of blue smoke. Many drivers find good results if they go very easy on the gas at first and leave the starting line without any wheel-spin; then, when the car is rolling 15 to 20 mph, they open the throttle wide and let the tires spin. An outstanding proponent of this latter method is Art Arfons, from Akron, Ohio. His machine, the Green Monster, is built on a lightweight tube frame, as are most drag-racing machines. Instead of the usual modified automobile powerplant, however, his dragster uses a 1450 hp., V-12, Allison aircraft engine; obviously his traction problems are greater than most. He uses four slicks mounted on dual truck wheels for traction. With this much power, if he opens the throttle upon leaving the starting line he does nothing more than burn up the tires. His best times have occurred when he comes off the starting line easy with no wheel spin and keeps his tires in that situation for almost 400 of the 1320 foot track. After he has gotten up to about 60 mph he opens it up. From that point to the finish line the Monster leaves four black lines of rubber on the asphalt. This machine has reached over 161 mph in one-quarter of a mile when driven by this method.

In only the most powerful machines is the problem of traction as acute with the one cited above. Actually many machines with only half this amount of horsepower have accelerated through a quarter of a mile quicker than the Green Monster, showing that brute torque and power above a certain point are not as important as traction.

These four factors; weight distribution, construction of the driving wheels, traction coefficient, and method of torque application; are the ones facing any builder and driver of a quickly accelerating vehicle. Regardless of how powerful the machine is, careful consideration of these factors will greatly improve acceleration.

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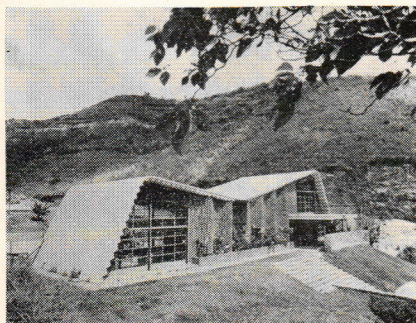
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ARCHITECTURE

(Continued from page 11)

Venezuelan architecture has been notably successful in its collaboration with art, too. Not only have its architects worked hand in hand with the nation's sculptors and artists, but with the creative genius of the United States and Europe as well. Fernand Legér, Jean Arp and Henri Laurens are among the European artists represented in breathtaking University City in Caracas—perhaps the most beautiful college campus in the world. Even the acoustical panels in the main auditorium of the University are more than mechanical devices; they are objects of art designed by Alexander Calder, the U. S. sculptor who originated the mobile.

Nowhere is the brilliant newness of Venezuela more evident than in its capital city, Caracas. There is color everywhere, drenched in brilliant sunshine: a spectacular hotel soaring upward from the top of the highest mountain overlooking the valley of Caracas, which is accessible via the hemisphere's largest cable car lift; "Centro Simon Bolivar," the twin-towered social, commercial and government center that dominates the center of the city; and everywhere, homes that seem personally designed for their inhabitants. Glass, steel and concrete have been shaped in a thousand forms, almost without restraint.



Courtesy Creole Oil Co.

And yet, there is an overriding unity that holds everything together—the youthful, surging spirit of a country old in time, young in heart.

A major exhibition of Venezuela's architecture is now touring the United States under the co-sponsorship of the Venezuelan Society of Architects and the Creole Petroleum Corporation. Creole, a U. S. company and Venezuela's largest oil producer, offered to prepare the exhibition and arrange its U. S. tour if the Society would design it and select the projects to be shown. Showings have already been held at several important museums and schools of architecture, and will continue through June of 1960.

A wide range of contemporary hotels, universities, office buildings, factories, private homes, housing projects and churches from various areas of the country are featured. Several outstanding examples of Venezuela's colonial architecture have been included for contrast.

If you are curious about the environment in which your grandchildren may live and play—watch for the exhibition.

It's the very best kind of news—beautiful, colorful, exciting.

• • •

SHORTHAND

(Continued from page 17)

The second is the ∂ , a modification of the phonetic ∂ , pronounced th. Alone, ∂ may mean *the*, *this* or *that*, depending on its context.

Example: "There is a definite relationship between the number of calls and the number of sales made" becomes, " ∂ r is a def rl \int s \int p btw ∂ # of cls & ∂ # of sls md."

7. Use mathematical symbols. Quite aside from numbers, mathematics is rich in easily understood symbols. Not only can + and — mean *plus* and *minus*, but in certain contexts they may stand for *pro* and *con*, *benefit* and *drawback*, *yes* and *no*, *more* and *less*, *positive* and *negative*, *including* and *excluding*.

Similarly, = may signify *the same as*, *means*, *stands for*, while \neq can mean *different from* or *does not mean*.

Thus, "Write me a letter explaining how your product is different from Acme's. Meanwhile, I'll discuss the pros and cons with my partner" becomes, "Rt me a ltr xpln— hw ur prod \neq Acme's. Mnwhl, I'l disc ∂ +s & —s w/my prtnr."

The simple multiplication sign, x, can serve for the word *times*, or as a suffix added to the numbers 1 or 2 to change them into *once* or *twice*. "It is not enough to see a customer once or twice; see him many times" becomes, "Nt enuf 2 c a cust 1x or 2x; c hm mny x."

Another sign, the arrow, may be used for such expressions as *leads into*, *turns into*, *yields*, *results in*. If you wanted to jot down, for example, the sentence, "Such a presentation might naturally lead into a discussion of competitive prices," you could write it, "Sch a pres mt ntrly \rightarrow a disc of comptv prcs."

Just seven rules. But they can mean the end of chaos and the beginning of a more orderly—and successful—business life. Try them!

B4 u no it, ul be rit— ur own nts n $\frac{1}{2}$ the tme!

• • •

SLIPSTICK SLAPSTICK

Neither side will ever win the battle of the sexes—mainly because there's too much fraternizing with the enemy.

"You say there was a burglar in the house while I was away? Did he get anything?"
"I'll say! I thought he was you."

Judge: "You admit that you drove over this man with a loaded truck. Well, what do you have to say in defense?"

Offender: "I thought he was dead."

Two morons each had a horse, but they couldn't decide which belonged to whom. So they cut the mane off one to differentiate, but it soon grew back. Next they cut the tail off one, but that also grew back. Finally they measured them and found that the black one was four inches taller than the white.

The original nitwit was the boy who poisoned his mother and father, then pleaded for mercy on the grounds that he was an orphan.

"Number, hell," yelled the drunk into the pay phone. "I want my peanuts."

And then there was the rather forlorn engineer who, on seeing a pigeon flying overhead, exclaimed, "Go ahead—everyone else does!"

Two young Irishmen had just gone up front during the Korean War, and their captain promised them \$1.00 for every one of the enemy they killed. Pat was asleep when he was awakened by Mike shouting, "The Reds are charging! Wake up!"

"How many are there?" asked Pat.

"About 50,000," exclaimed Mike.

"Begorrah," shouted Pat, jumping up and grabbing his rifle, "our fortune is made!"

Many of the girls you see at college are at the age where their voices are changing—from no to yes.

She thinks no man is good enough for her.
She may be right.
She may be left.

"Someone lend me a slide rule."

"Here, use log tables."

"G'wan, you can't hammer tacks with a log book."

Never try to judge a woman by her clothes. There just isn't enough evidence.

Prof.: "Are you lecturing to this class?"

Student: "No, sir."

Prof.: "Well, then sit down and stop acting like an idiot."

Frosh to date: "Since I met you, I can't eat, I can't sleep, I can't even enjoy a smoke!"

Co-ed, coyly: "Why not?"

Frosh: "I'm broke."

One of our student engineers who had the pleasure of working down South last summer attended a party in New Orleans and approached a girl wearing a rather daring, low-cut gown. "That's a lovely dress you have on, honey," he said.

"Sho' enough?" she drawled.

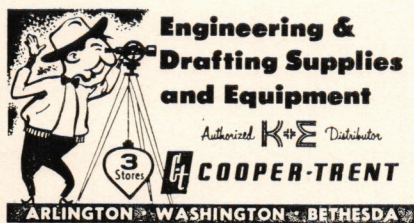
"It sure does!"

Introducing the new deacon to her partially-deaf father, a young girl said, "Father, this is the new deacon."

"New dealer," exclaimed the father in surprise.

"No, no. Not a new dealer; a new deacon. He's the son of a bishop."

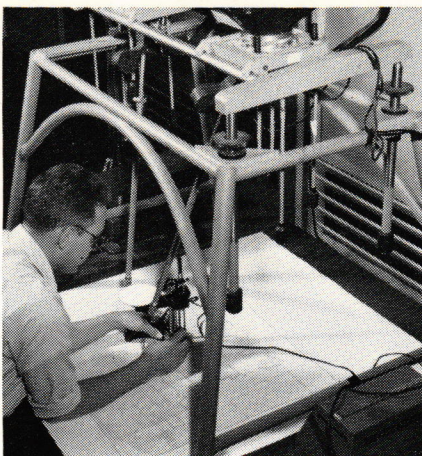
The father nodded wisely, "They all are."





1

By setting templates of standard components on photo-sensitive paper and exposing it, hours of hand drafting are saved.



2

With this plotter, stereo aerial photos become contour maps, show highway routes, mineral-bearing formations, volume of coal piles.



3

Slides give the sales staff quick understanding of the engineering superiority of their product—equip them with facts for their customers.



4

Photographs of freight cars as loaded and as received provide information for engineers to develop better loading practices (as well as data for damage claims).

From drawing board
to shipping platform...

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One of a series

Interview with General Electric's
Hubert W. Gouldthorpe
Manager—Engineering Personnel

Your Salary

Although many surveys show that salary is not the prime factor contributing to job satisfaction, it is of great importance to students weighing career opportunities. Here, Mr. Gouldthorpe answers some questions frequently asked by college engineering students.

Q. Mr. Gouldthorpe, how do you determine the starting salaries you offer graduating engineers?

A. Well, we try to evaluate the man's potential worth to General Electric. This depends on his qualifications and our need for those qualifications.

Q. How do you evaluate this potential?

A. We do it on the basis of demonstrated scholarship and extra-curricular performance, work experience, and personal qualities as appraised by interviewers, faculty, and other references.

Of course, we're not the only company looking for highly qualified men. We're alert to competition and pay competitive salaries to get the promising engineers we need.

Q. When could I expect my first raise at General Electric?

A. Our primary training programs for engineers, the Engineering Program, Manufacturing Program, and Technical Marketing Program, generally grant raises after you've been with the Company about a year.

Q. Is it an automatic raise?

A. It's automatic only in the sense that your salary is reviewed at that time. Its amount, however, is not the same for everyone. This depends first and foremost on how well you have performed your assignments, but pay changes do reflect trends in over-all salary structure brought on by changes in the cost of living or other factors.

Q. How much is your benefit program worth, as an addition to salary?

A. A great deal. Company benefits can be a surprisingly large part of employee compensation. We figure our total benefit program can be worth as much as 1/6 of your salary, depending on the extent to which you participate in the many programs available at G.E.

Q. Participation in the programs, then, is voluntary?

A. Oh, yes. The medical and life insurance plan, pension plan, and savings and stock bonus plan are all operated on a mutual contribution basis, and you're not obligated to join any of them. But they are such good values that most of our people do participate. They're an excellent way to save and provide personal and family protection.

Q. After you've been with a company like G.E. for a few years, who decides when a raise is given and how much it will be? How high up does this decision have to go?

A. We review professional salaries at least once a year. Under our philosophy of delegating such responsibilities, the decision regarding your raise will be made by one man—the man you report to; subject to the approval of only one other man—his manager.

Q. At present, what salaries do engineers with ten years' experience make?

A. According to a 1956 Survey of the Engineers Joint Council*, engineers with 10 years in the electrical machinery manufacturing industry were earning a median salary of \$8100, with salaries ranging up to and beyond \$15,000. At General Electric more than two thirds of our 10-year, technical college graduates are earning above this industry

median. This is because we provide opportunity for the competent man to develop rapidly toward the bigger job that fits his interests and makes full use of his capabilities. As a natural consequence, more men have reached the higher salaried positions faster, and they are there because of the high value of their contribution.

I hope this answers the question you asked, but I want to emphasize again that the salary *you* will be earning depends on the value of *your* contribution. The effect of such considerations as years of service, industry median salaries, etc., will be insignificant by comparison. It is most important for you to pick a job that will *let* you make the most of your capabilities.

Q. Do you have one salary plan for professional people in engineering and a different one for those in managerial work?

A. No, we don't make such a distinction between these two important kinds of work. We have an integrated salary structure which covers both kinds of jobs, all the way up to the President's. It assures pay in accordance with actual individual contribution, whichever avenue a man may choose to follow.

* We have a limited number of copies of the Engineers Joint Council report entitled "Professional Income of Engineers—1956." If you would like a copy, write to Engineering Personnel, Bldg. 36, 5th Floor, General Electric Company, Schenectady 5, N. Y. 959-7

LOOK FOR other interviews discussing: • Advancement in Large Companies • Qualities We Look For in Young Engineers • Personal Development.

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